Hints for Shape Factors on Class Project

Due Date: 22 April 2004 (Thursday)

1 Useful Hint

Several students requested some help in calculating the shape factors for the Laplacian azimuth spectrum used in the project. Recall that the Laplacian azimuth spectrum is given by

$$p(\theta) = A \exp\left(-\left|\frac{\theta - \theta_0}{\theta_1}\right|\right)$$

The constant A is arbitrary (it will only change the average received power, not the shape of the distribution or the statistics of the fading.) The value θ_0 is the azimuth direction of peak arrival and, in general, points in the direction of the base station transmitter. The value θ_1 is related to the thickness of the distribution.

The nth Fourier coefficient of this spectrum is given by

$$F_n = \frac{2A\theta_1 \exp(jn\theta_0)}{n^2\theta_1^2 + 1}\left[1 - (-1)^n \theta_1 \exp\left(-\frac{\pi}{\theta_1}\right)\right]$$

where θ_0 and θ_1 are in radians. Just plug in the values for your $\theta_1 = 120°$ and $\theta_1 = 3°$ models and solve for angular spread (Λ), angular constriction (γ), and direction of maximum fading (θ_{max}).

A few hints about what your results should look like:

- The angular spread should always be a number between 0 and 1. The angular spread for the $\theta_1 = 120°$ case will be much larger than the angular spread for the $\theta_1 = 3°$ case.
- The angular constriction should also always be a number between 0 and 1. The angular constriction for the $\theta_1 = 120°$ case will be smaller than the angular constriction for the $\theta_1 = 3°$ case.
- The direction of maximum fading for both cases should be 90° away from the peak of the azimuth distribution (θ_0).